

What Is Claimed Is:

1. Anelectronemissionelement comprising a substrate,
and a protrusion protruding from the substrate and including
boron-doped diamond:

5 the protrusion comprising a columnar body;

a tip portion of the protrusion comprising an acicular
body sticking out therefrom; and

the distance r [cm] between a center axis and a side face
in the columnar body and the boron concentration N_b [cm⁻³] in
10 the diamond satisfying the relationship represented by the
following formula (1):

$$r > \frac{10^4}{\sqrt{N_b}} \quad (1).$$

2. The electron emission element according to claim
1,

15 wherein the distance r [cm] between the center axis and
side face in the columnar body is 0.1 μm or less; and

wherein the boron concentration in the diamond is 5×10^{19}
cm⁻³ or more.

3. Anelectronemissionelement comprising a substrate,
20 and a protrusion protruding from the substrate and including
boron-doped diamond:

the protrusion comprising a columnar body;

a tip portion of the protrusion comprising an acicular
body sticking out therefrom;

25 diamond crystal included in the tip portion of the
protrusion being terminated with hydrogen; and

the distance r [cm] between a center axis and a side face in the columnar body and the boron concentration N_b [cm^{-3}] in the diamond satisfying the relationship represented by the following formula (2):

$$r > \frac{10^2}{\sqrt{N_b}} \quad (2).$$

4. The electron emission element according to claim 1,

wherein the diamond is doped with nitrogen; and

wherein the boron concentration N_b [cm^{-3}] in the diamond is higher than the nitrogen concentration N_n [cm^{-3}] therein.

5. The electron emission element according to claim 4,

wherein the diamond is doped with nitrogen; and

wherein the boron concentration N_b [cm^{-3}] and nitrogen concentration N_n [cm^{-3}] in the diamond satisfy the relationship represented by the following formula (3):

$$N_b - N_n < 6 \times 10^{18} \quad (3).$$

6. The electron emission element according to claim 1, wherein the protrusion protrudes from a (111) sector of a diamond formed by a high pressure-high temperature synthesis.

7. The electron emission element according to claim 3, wherein the protrusion protrudes from a (311) or (110) sector of a diamond formed by a high pressure-high temperature synthesis.

8. The electron emission element according to claim 1, wherein the substrate comprises a diamond formed by a vapor-phase synthesis.